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Experiential avoidance in non-suicidal self-injury and suicide experiences: A systematic review and meta-analysis

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Email: ioannis.angelakis@southwales.ac.uk**Abstract****Introduction:** This systematic review and meta-analysis aimed to (i) examine the associations between experiential avoidance (EA), non-suicidal self-injury (NSSI), and suicide experiences, and (ii) identify sample- and methodological-related variables affecting the strength of these associations.**Method:** Medline, Embase, PsychINFO, Web of Science, and CINAHL were searched until April 2020. Random-effect meta-analyses were applied. The I^2 statistic and the Egger's test assessed heterogeneity and publication bias. Meta-regression analyses were used to evaluate the impact of moderator variables on the strength of these associations.**Results:** Data from 19 independent studies based on $n = 9900$ participants were pooled. The analyses demonstrated a weak but significant association between EA and NSSI. None of the examined moderator variables influenced the strength of this relationship. There was an indication of publication bias, suggesting that this association may have been inflated. The associations between EA, and suicide ideation and behaviors were moderate to strong.**Discussion:** The current study concluded that (i) the EA model for NSSI should be revised by incorporating new evidence implicating feelings of relief in NSSI, and (ii) future studies should examine interactive factors between EA and key psychological components in the pathways to suicide experiences because these findings have direct clinical implications.

INTRODUCTION

Deliberate engagement in non-suicidal self-injury (NSSI) involves such behaviors as damaging and/or deforming skin by cutting, kicking, scratching, pulling hair, carving and burning, among others, in targeted body areas (Claes & Vandereycken, 2007; Zatterqvist, 2015). The prevalence estimates of these types of NSSI within an American adult sample ranged between 4% and 5.9% (Briere & Gil, 1998; Klonsky, 2011), whereas the prevalence estimates of these acts across clinical,

adolescent, and college populations appeared comparatively higher ranging between 11.7% and 21.0% (Briere & Gil, 1998; Heath et al., 2008; Muehlenkamp et al., 2012). Although NSSI is distinguished from suicide thoughts and behaviors in that individuals who self-injure are characterized as not consciously intending to die (Brausch & Gutierrez, 2010), NSSI has been strongly associated with suicide experiences. In particular, recent studies have identified that a prolonged engagement in NSSI was associated with suicide ideation and attempts in adolescents on psychiatric in-patient wards, high

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school students, college learners, and adults from the community (Anestis et al., 2013; Klonsky et al., 2013).

Suicide ideation refers to thoughts, urges, or plans about killing oneself, whereas suicide attempts are deliberate acts to die by suicide that do not result in actual deaths (Hawton et al., 2012; Klonsky et al., 2016). Within American adolescent and adult populations, the prevalence estimates of suicide ideation range between 9.2% and 10.9%, whereas the estimates of suicide attempts range between 2.7% and 3% (Nock et al., 2008; Wolitzky-Taylor et al., 2010). Having suicide experiences, such as thoughts, urges, plans, and acts, are strong predictors of suicide deaths (Johnson et al., 2010; Joiner, 2005; Kapur et al., 2015). Therefore, there is an urgent need to identify key explanatory factors that can contribute to, and therefore, help explain any overlap in the pathways to both NSSI and suicide acts.

Recent evidence has implicated experiential avoidance (EA) or states of psychological inflexibility¹ as a potentially important factor in the engagement of NSSI and/or suicide ideation and behaviors (Angelakis & Gooding, 2020; Brausch & Woods, 2019). The EA model posits that the individual experiencing the avoidance is unable, or unwilling, to endure internal sources of aversive stimulation, including unwanted cognitions (e.g., memories and beliefs), mental images (e.g., forest fires and motor vehicle accidents), uncomfortable emotions (e.g., anger and fear), and/or bodily sensations (e.g., hunger, sweating) that can enact escape and/or avoidance behaviors (Hayes et al., 1996). As such, an individual who engages in avoidance behaviors may be able to terminate, in the short term, their distressing thoughts and/or emotions by escaping or avoiding the situations, activities, and/or people responsible for their development. To illustrate, someone who is faced with grief may try to control or avoid some of those difficult, and potentially overwhelming, feelings by using substances (e.g., Creighton et al., 2016). Another example is that people who tend to be perfectionists and to avoid failure may use procrastination-related thoughts and behaviors to ensure that failure does not occur (e.g., Jadidi et al., 2011).

According to the EA framework, self-injury is viewed as an avoidance and escape behavior in relation to (i) low tolerance of unwanted, distressing, cognitions and/or emotions, and/or (ii) the experience of uncontrollable heightened emotional arousal (Chapman et al., 2006). Engagement in self-injury can narrow attention to physical pain experienced in

the here and now which can also alleviate acute distress (e.g., Brown et al., 2002; Franklin et al., 2010). When the desired outcome is achieved, it appears that these avoidance thoughts and behaviors are negatively reinforced by re-establishing a sense of positive achievement. Therefore, EA is considered to be a maladaptive emotion regulation coping strategy, where the individual, who initially has problems with controlling their internal mood states, engages in NSSI in an effort to escape from extreme negative distress and, consequently, restore and attain more positive mood states, and/or neutralize distress (e.g., Gratz et al., 2002). Evidence, thus far, has widely supported this purported role of EA in NSSI (Brausch & Woods, 2019; Greene et al., 2019; Xavier et al., 2018). For example, it has been found that NSSI improved perceived escape from intrusive thoughts and/or potentially overwhelming and distressing negative emotions, such as, tension, stress, and anger (Anderson et al., 2018; Klonsky, 2007, 2009).

Psychological models of suicide thoughts and behaviors have highlighted the perception of being trapped by immense psychological pain and distress as being central in the pathways to suicide experiences (Johnson et al., 2008; O'Connor, 2011; Williams, 1997). Furthermore, the key role of entrapment in the pathways to suicide thoughts and behaviors is supported by vast and expanding qualitative (Owen et al., 2015) and quantitative evidence (Taylor et al., 2011). Such evidence appears transdiagnostic in that it applies to bipolar disorder, post-traumatic stress disorder (PTSD), and psychosis (Gooding et al., 2015; Owen et al., 2018; Panagioti et al., 2013; Shelef et al., 2016). EA may be an important aspect in escaping from intense and overwhelming feelings of being trapped in the pathways to suicide experiences. Indeed, research is accumulating that demonstrates the role of EA in a range of suicide experiences (Chou et al., 2018; Ellis & Rufino, 2016; Roush et al., 2019; Zvolensky et al., 2015, 2016). Furthermore, new evidence has supported the strong associations between EA and obsessive-compulsive and related disorders, including obsessive-compulsive disorder, hoarding disorder, body dysmorphic disorder and hair-pulling disorder (Angelakis & Pseftogianni, 2021) which also have been strongly associated with suicide and related behaviors (e.g., Angelakis et al., 2015; Angelakis et al., 2016).

Hence, the investigation of EA in pathways to both self-injury and suicide experiences is important, from theoretical and clinical perspectives. A recent systematic review supported the role of EA in self-injury (Brereton & McGlinchey, 2020). However, the authors did not provide a quantitative synthesis of this evidence, which is important in corroborating their findings. Furthermore, a systematic synthesis of the evidence examining the strength of the association between EA, and suicide ideation and behaviors is currently lacking. Therefore, we undertook the first systematic review and meta-analysis of the associations between EA, self-injury, and suicide experiences. There were two key objectives:

¹We acknowledge that experiential avoidance and psychological inflexibility are close but not related theoretical constructs. Psychological inflexibility is a broader construct referring to the individual's inability to (i) focus on the present moment, and (ii) adapt to the various life conditions by disregarding their goals and/or values (e.g., DeBeer et al., 2018). However, we included both of these terms in our searches to ensure that all relevant studies examining the associations between experiential avoidance, NSSI and suicide acts will be identified and included in our quantitative synthesis.

1. To synthesize quantitatively evidence pertaining to the relationships between (a) EA and self-injury, and (b) EA and suicide ideation and behaviors;
2. To examine whether the strength of these relationships was affected by key methodological (e.g., research design, screening tools for measuring NSSI and suicide experiences) and participant-related characteristics (e.g., age and gender).

METHOD

Selection of papers

The criteria of both the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Moher et al., 2009) and the Meta-Analysis of Observational Studies in Epidemiology (Stroup et al., 2000) statements were used in this systematic review and meta-analysis. The strategy used to identify papers included (i) searching five bibliographic databases, namely, Medline, PsycINFO, Embase, Web of Science, and CINAHL, (ii) screening the reference lists of the studies which met the inclusion criteria, and (iii) contacting the authors in cases where additional information was needed to carry out meta-analyses. The searches were conducted from inception until the end of April 2020 and included three key terms: EA or psychological inflexibility (experient* avoid* OR psychology* inflexib*) together with NSSI, deliberate self-harm (self* injur* OR self* harm*), or suicide (suicid*). The titles and abstracts of the identified papers were screened by three independent raters, including the first author (IA) and two additional raters who determined the eligibility of the papers for inclusion in the current review. Interrater agreement was excellent ($\kappa = 100\%$).

Eligibility criteria

The studies were included that:

1. Reported a quantitative outcome of the links between EA, NSSI, and/or suicidal experiences;
2. Were focused on both children/adolescents and adult populations;
3. Used a quantitative research design and analysis;
4. Were written in English and published in peer-reviewed scientific journals

The studies were excluded that:

1. Were reviews, theses/dissertations, reports, theoretical papers, position papers, or any other papers which were unpublished or published in non-academic forums (e.g.,

- gray literature including reports for companies, governments, third sector organizations);
2. Did not provide data amenable for meta-analyses.²

Data extraction

A database was devised and piloted using five randomly selected papers to assess its efficacy to capture all the important and identified variables. Descriptive information was extracted including: country of study; mean age; proportion of participants self-identifying as male, female, or other; population targeted (e.g., community samples, those with a psychiatric diagnosis); research design; methods of measuring EA; and screening tools for self-injury and for suicide experiences. Quantitative data which reported associations between EA, NSSI, and suicide experiences were also extracted. All data extraction was performed by the first author (IA) and two independent raters. Interrater agreement was very high ($\kappa = 0.97$). Disagreements were resolved through discussions.

Critical evaluation of the methodological quality of the studies

The included studies were assessed for the quality of the methods employed against four criteria as adopted by the Centre for Reviews and Dissemination (CRD, 2010) guidance for undertaking reviews in health care. The first author (IA) together with two independent raters were involved and inter-rater agreement was excellent ($\kappa = 100\%$). The criteria to assess risk of bias were as follows: (i) methodological design (prospective/longitudinal/experimental = 2, cross-sectional = 1), (ii) response rate at baseline/follow-up ($\geq 70\% = 2$, $\leq 70\%$ or not reported = 1), (iii) measuring tools for self-injury and suicide experiences (structured or semi-structured interviews = 2; self-report scales or not reported = 1), and (iv) control for confounding factors in the analysis (controlled = 2, not controlled/not reported = 1). The overall quality assessment scores were entered into the meta-regression analyses to perform sensitivity analyses (Bown & Sutton, 2010).

Data analyses strategy

The Data Analysis Strategy had two subsections that concerned (i) the meta-analyses and (ii) the meta-regression analyses.

²Studies whose data could not be converted into standardized mean differences (SMD) and pooled in the meta-analyses.

Meta-analyses

The relationships between EA, NSSI, and suicide experiences were examined by calculating effect sizes in the form of standardized mean differences (SMDs) and their associated 95% confidence intervals (CI), which were, then, pooled in Stata 16[®] using the *metan* command (Kontopantelis & Reeves, 2010). To avoid discounting any effect sizes, we used a common strategy according to which an average effect size is computed and entered into the analysis (e.g., Siddaway et al., 2015) for those studies which contributed more than one effect size for the same relationship (Anderson & Crowther, 2012) or reported different modes of suicide behavior (DeBeer et al., 2018; Rogers & Joiner, 2018). Subgroup analyses were performed to examine different modes of suicide experiences (e.g., ideation, plans, and attempts), where possible, in relation to EA. According to published guidelines (Higgins et al., 2003; Hunter & Schmidt, 2000), random-effects models were utilized because they are less prone to false-positive conclusions (e.g., Type I bias). Publication bias was assessed through visual inspection of the funnel plots and by applying the Egger's test, for those comparisons that were based on nine or more independent effect sizes (Egger et al., 1997). We used the Duval and Tweedie's (2000) trim-and-fill method, which produces corrections to the estimated effect sizes by computing a probable number of missing studies when publication bias is present. The strength of the associations was interpreted by using Cohen's (1988) guidelines, where $d = 0.20$, $d = 0.50$, and $d = 0.80$ are considered low, medium, or large, respectively.

Meta-regression analyses

Univariate meta-regression analyses were performed, using the *metareg* command in Stata 16[®] (Harbord & Higgins, 2008), to examine whether participant-related characteristics, such as age as a continuous or dichotomous variable (1 indicates ≤ 18 ; 2, > 18); percentage of those identifying as male; type of population (1 indicates individuals from the general community [with or without diagnosed mental health problems]; 2, psychiatric in-patients/primary care individuals or other [e.g., veterans, inmates]; methodological factors, including percentage of response rates; research designs (1 indicates cross-sectional; 2, prospective/experimental); instruments used for measuring EA [1 indicates Acceptance & Action Questionnaire (AAQ); 2, AAQ-Revised; 3, other (e.g., the Multidimensional EA Questionnaire)]; screening tools for suicide thoughts and behaviors (1 indicates not reported or self-report scale; 2, structured or semi-structured clinical interview); and overall risk of bias scores, affected the strength of the observed

relationships between EA, NSSI, and suicide experiences. In the event that multiple moderators were identified, we planned to conduct multivariate meta-regression analyses. The meta-regression analyses were conducted only for comparisons which incorporated eight or more independent effect sizes (Thompson & Higgins, 2002).

RESULTS

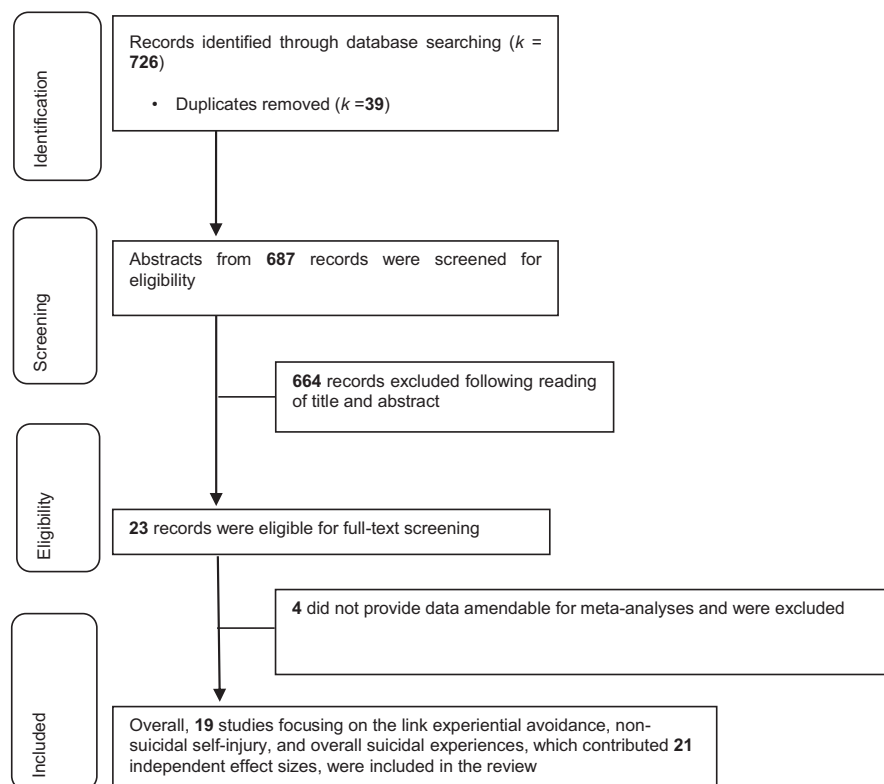
Our search yielded 726 papers, of which 39 were removed because they were duplicates. In total, we retrieved and screened full-text copies of 687 papers. Of those, 664 articles were removed because they did not fulfill the full inclusion criteria. Twenty-three studies met the eligibility criteria for inclusion. However, four studies, which did not provide data amendable for meta-analyses, were excluded because either the lead authors did not provide the required data or because these data were not available. Hence, this systematic review and meta-analysis was based on 19 independent studies (see Figure 1) as follows: 11 studies contributed a total number of 13 independent effect sizes and focused on the relationship between EA and NSSI; seven studies examined the relationship between EA and suicide experiences that comprised an amalgamation of suicide attempts, ideations and/or plans; and four studies examined the relationship between EA and suicide ideation. Notably, none of these studies investigated NSSI and suicide experiences using the same sample.

The overall number of participants was 9900 with a mean age of 25.9 ($SD = 8.86$). This sample mainly comprised people from the general community and university students (see Table 1). The majority of the studies were conducted in the United States of America ($k = 14$; 73.68%), with two studies being conducted in the United Kingdom (10.53%), and a single (5.26%) study each conducted in Canada, Portugal, and Taiwan.

Meta-analyses of the link between EA and NSSI

The pooled effect size across 13 comparisons for the relationship between EA and NSSI was small but significant [$SMD = 0.38$, $CI = 0.26$ to 0.49 , $p < 0.001$], and exhibited high heterogeneity ($I^2 = 89.7$; see forest plot in Figure 2). Of the 13 individual comparisons, eight had clear significant effects. The inspection of the funnel plot indicated publication bias, meaning that there was a tendency for studies reporting a negative relationship between EA and NSSI to remain unpublished. This was also confirmed by running the Egger's test for publication bias which was significant (Egger's regression $p = 0.001$; see Figure 3). To account for this, we applied the Duval and Tweedie's trim-and-fill method, which reduced the

FIGURE 1 PRISMA flow diagram for the entire review



effect size from $SMD = 0.38$ to 0.17 . This reduced effect size was based on a probable estimation of the unpublished studies which could not be included in the current meta-analysis. Therefore, it may indicate publication bias for this relationship and, as such, caution should be applied when interpreting this pattern of findings (Murad et al., 2018).

Meta-analyses of the link between EA and overall suicide experiences

In total, seven studies were identified examining the relationship between EA and overall suicide experiences that included suicide ideation, attempts and/or plans. The pooled effect size was medium ($SMD = 0.60$, $95\% CI = 0.29$ to 0.91), but heterogeneity was high ($I^2 = 96.8$; see the forest plot in Figure 4). Only one study reported non-significant effects. The limited number of studies prevented us from running formal publication bias tests for this relationship (Saveleva & Selinski, 2008). Therefore, these results should be interpreted with caution.

Subgroup analyses: meta-analyses of the link between EA and suicide ideation

Four independent studies provided data for the relationship between EA and suicide ideation (DeBeer et al., 2018; Ellis & Rufino, 2016; Rogers & Joiner, 2018; Roush et al., 2019).

The pooled effect size indicated a moderate to large association ($SMD = 0.71$, $CI = 0.57$ to 0.85 ; see the forest plot in Figure 5), with no substantial heterogeneity ($I^2 = 0$). These findings should be interpreted with caution because of the low number of comparisons.

Meta-regression analyses

Univariate meta-regression analyses were conducted only for the link between EA and NSSI because there were sufficient comparisons to justify this analysis (Thompson & Higgins, 2002). In total, we assessed nine moderators which included age as a continuous variable ($p = 0.72$), age as a categorical variable ($p = 0.30$), percentage of males ($p = 0.29$), percentage of response rate of those who completed the studies ($p = 0.51$), type of research design ($p = 0.49$), type of population ($p = 0.86$), type of instrument assessing EA ($p = 0.93$), screening tests for suicide thoughts and behaviors ($p = 0.86$), and overall quality appraisal score ($p = 0.40$; see Table 1). None of the moderators examined were found to affect the strength of the relationship between EA and NSSI (see Table 2).

DISCUSSION

This is, to our knowledge, the first systematic review with meta-analysis to examine the relationships between EA, NSSI, and suicide experiences which was based on 9900

TABLE 1 Descriptive characteristics of the included studies

Study	Country	Research design	Screening tool for EA	Screening tool for suicidal ideation and acts, and non-suicidal self-injury (NSSI)	Mode of suicidal ideation and acts, and non-suicidal self-injury (NSSI)
Anderson and Crowther (2012)	USA	CS	AAQ	DSHI	NSSI
Anderson et al. (2018)	USA	CS	AAQ	DSHI	NSSI
Angelakis and Gooding (2020)	UK	CS	AAQ-2	SBQ-R	SI & SB
Brausch and Woods, ()	USA	FU	AAQ-2	SIQ-JR	SI
Chapman et al. (2005)	USA	CS	AAQ	LPC-2 Interview	NSSI
Chou et al., (2018)	Taiwan	FU	AAQ	Questions from the Kiddie-SADS-E	SI & SA
DeBeer et al., (2018)	USA	FU	AAQ-2	The CSSRS Interview	SI & SA & NSSI
Ellis and Rufino (2016)	USA	CT	AAQ-2	SCS & BSSI	SI
Gratz et al., (2010)	USA	CS	AAQ	DSHI	NSSI
Greene et al., (2019)	USA	CS	BEAQ	ISAS	NSSI
Howe-Martin et al., (2012)	USA	CS	AFQ-Y	DSHI	NSSI
Nielsen et al., (2016)	UK	CS	AAQ-2	ISAS	NSSI
Rogers and Joiner (2018)	USA	CS	BEAQ	BSSI & SRS	SI & SA
Roush et al., (2019)	USA	CS	AAQ-2	BSSI	SI
Skinner et al., (2017)	USA	CS	MEAQ	SBQ-R	SI & SB
Turner et al., (2015)	Canada	CS	AAQ	DSHI	NSSI
Xavier et al., (2018)	Portugal	CS	AFQ-Y	RTSHIA	NSSI
Zvolensky et al., (2015)	USA	CS	AAQ-2	IDAS	SI & SB
Zvolensky et al., (2016)	USA	CS	MEAQ	IDAS	SI & SB

Abbreviations: AAQ, The Acceptance and Action Questionnaire; AAQ-2, The Acceptance and Action Questionnaire-Revised; AFQ-Y, The Avoidance and Fusion Questionnaire for Youth; BEAQ, The Brief Experiential Avoidance Questionnaire; BSSI, The Beck Scale for Suicide Ideation; CT, Clinical Trial; CS, Cross-Sectional; DSHI, The Deliberate Self-Harm Inventory; FU, Follow-Up; GC, General Community; IDAS, Inventory of Depression and Anxiety Symptoms; ISAS, The inventory of statements and self-injury; Kiddie-SADS-E, Kiddie Schedule for Affective Disorders and Schizophrenia; LPC-2, Lifetime Parasuicide Count-2 (LPC-2) interview; MEAQ, Multidimensional Experiential Avoidance Questionnaire; PCI, Primary Care Individuals; PI, Psychiatric Inpatient; SBQ-R, Suicidal Behaviors Questionnaire-Revised; SCS, The Suicide Cognitions Scale; SRS, Suicide Rumination Scale; SIQ-JR, Suicide Ideation Questionnaire-Junior; RTSHIA, The Risk-taking and Self-harm Inventory for Adolescents; US, University Students.

participants across 19 independent studies that provided a total of 21 effect sizes. This meta-analysis contributes to the extant literature by (i) quantifying the effect sizes for each of these relationships, (ii) examining potential moderating variables, and (iii) by applying formal publication bias tests when appropriate.

Overall, there were three key findings. First, the relationship between EA and NSSI was weak but significant. Of the 13 comparisons examined, eight contributed positive and significant effects. Furthermore, none of the potential moderators examined appeared to affect this relationship significantly, whereas there was an indication of publication bias suggesting that this relationship may be inflated. In other words, it seems that those studies that found a weaker or negative outcome remain unpublished, and, as such, were not included in the

current meta-analysis (see Thornton, & Lee, 2000). Second, the effect sizes between EA, suicide ideation, and behaviors were moderate to strong lending confidence to the proposition that EA may play a key role in the pathways to suicide experiences. We identified only two studies that have extended this relationship to suicide attempts. The study of DeBeer et al., (2018), which was focused on an American veteran sample, demonstrated a moderate relationship between EA and suicide attempts, whereas the study conducted by Rogers and Joiner (2018), which recruited community samples, failed to establish such a significant relationship. Therefore, more extensive research efforts are needed to examine this association in both community and/or targeted samples (e.g., individuals on psychiatric in-patient wards, veterans, prisoners). The third key finding was that the majority of the included studies

Sample size and response rate	Mean age	Male (%)	Population	Quality appraisal Scores
214, response rate = 100%	$M_{\text{age}} = 18.86; SD = 1.97$	30%	US	2
230, response rate = 100%	$M_{\text{age}} = 18.76; SD = 2.99$	0%	US	2
1046, response rate = 100%	$M_{\text{age}} = 34.27; SD = 12.51$	41.97%	GC	3
T1: 436; T2: 373, response rate = 85.5%; T3: 367, response rate = 84.2%	$M_{\text{age}} = 13.19; SD = 1.19$; Range: 11–16 at baseline	46.4%	GC	3
117, response rate = 89.74	$M_{\text{age}} = 33.90; SD = 8.52$	0%	Inmates	2
T1:500; T2: 324, response rate = 65.8%	$M_{\text{age}} = 22.1; SD = 1.8$	47.6%	US	2
T1: 309; T2: 276, response rate = 89.3	$M_{\text{age}} = 38.8; SD = 9.8$	67.6%	Veterans	3
189, response rate = 82%	$M_{\text{age}} = 33.11; SD = 13.26$; Range: 18–70	43%	PI	2
392, response rate = 100%	$M_{\text{age}} = 20.25; SD = 2.46$	26%	US	2
778, response rate = 100%	$M_{\text{age}} = 22.27; SD = 6.71$	22.9%	US	1
211, response rate = 99.53%	$M_{\text{age}} = 16.22; SD = 1.23$	48.3%	Schoolchildren	1
1332, response rate = 100%	$M_{\text{age}} = 19.57; SD = 6.22$; Range: 16–69	75.2%	GC	2
540, response rate = 38.7%	$M_{\text{age}} = 36.12; SD = 12.02$	38.8%	US	0
118, response rate = 100%	$M_{\text{age}} = 36.17; SD = 15.30$	53.4%	PI	1
218, response rate = 100%	$M_{\text{age}} = 32.33; SD = 9.57$	33.9%	GC with NSSI and suicidal acts	0
931, response rate = 100%	$M_{\text{age}} = 20.26; SD = 3.22$; Range: 17–54	28.7%	US	2
776, response rate = 100%	$M_{\text{age}} = 14.55; SD = 1.76$; Range: 12–18	47.6%	Schoolchildren	1
138, response rate = 100%	$M_{\text{age}} = 38.4; SD = 10.8$	13.8%	PCI	1
1095, response rate = 64.75%	$M_{\text{age}} = 21.92; SD = 4.23$; Range: 18–52	21.9%	US	0

had adopted a cross-sectional design, had primarily recruited a community sample, and scored low in the methodological quality appraisal exercise, which may also account for the weak association between EA and NSSI.

It has been suggested that NSSI, and suicide thoughts and behaviors are highly associated (for a review see Hamza et al., 2012). Therefore, it was surprising that EA was weakly associated with NSSI yet more strongly associated with overall suicide experiences. This recommends that the differential emotional regulation functions of NSSI, and suicide thoughts and behaviors would benefit from qualitative work examining ways in which they interact, perhaps in a cyclical fashion. This finding that there was a weak association between EA and NSSI also calls for a crucial re-evaluation of the EA model (EAM; Chapman et al., 2006). According to

EAM, NSSI is maintained through negative reinforcement, meaning that individuals tend to terminate unpleasant emotions and/or thoughts by engaging in self-destructive forms of avoidance behavior. The EAM posits that there is almost always an external event which induces unpleasant emotional responses. The individual, who is mainly characterized by a low threshold of tolerance of such aversive emotional states, self-injures in an effort to escape their upsetting feelings and associated cognitions. This constitutes an example of negative reinforcement which appears to maintain their engagement in NSSI because such behaviors are effective in reducing the individual's unpleasant feelings (e.g., Nock, 2009). A vicious circle is, then, developed through which the relationship between unwelcome emotional arousal and NSSI is strengthened.

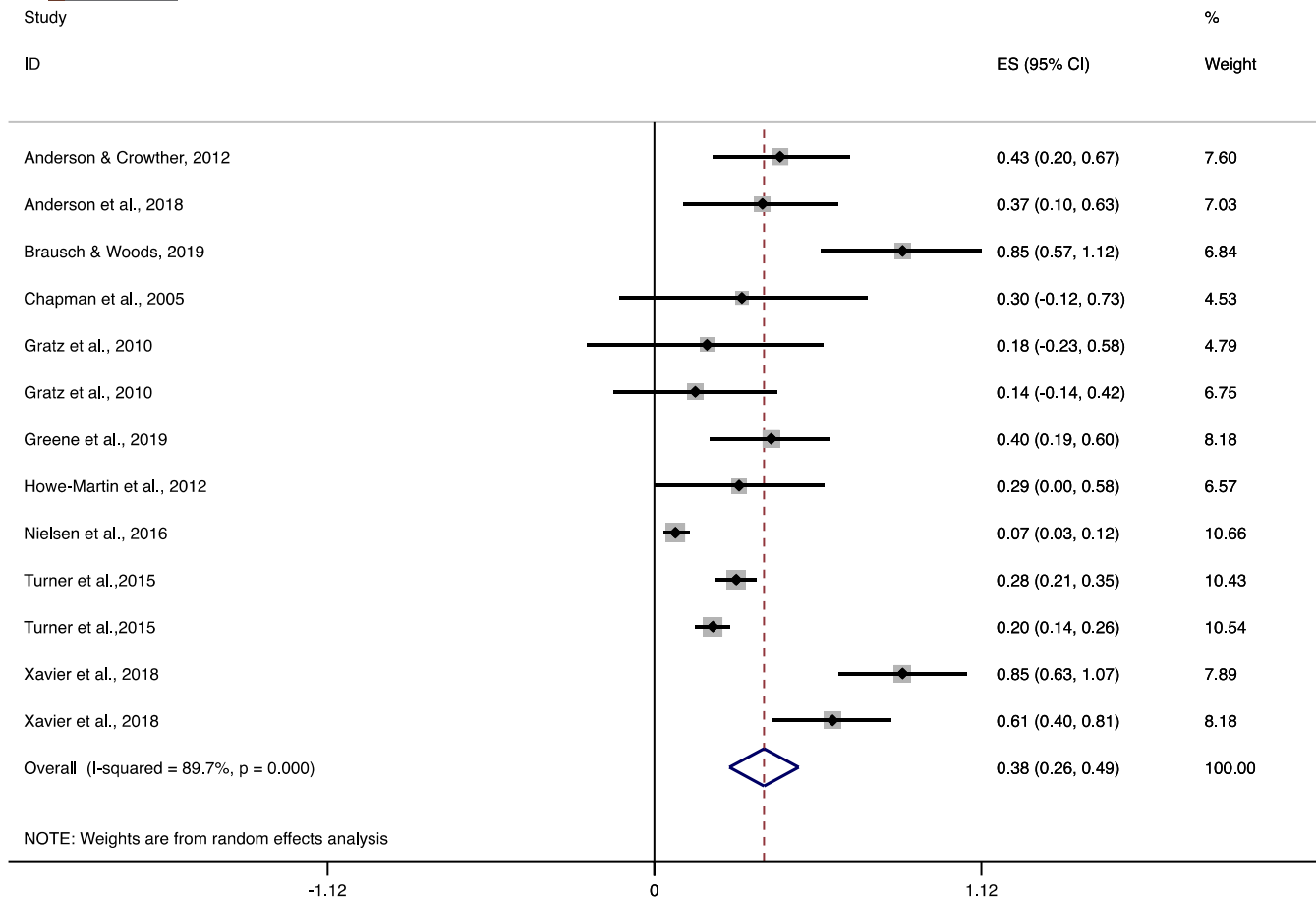


FIGURE 2 Forest plot of the main meta-analysis of the association between EA and NSSI. Note: Random-effects model used; 95% CI, 95% Confidence Interval; ES, Standardized Mean Difference (SMD)

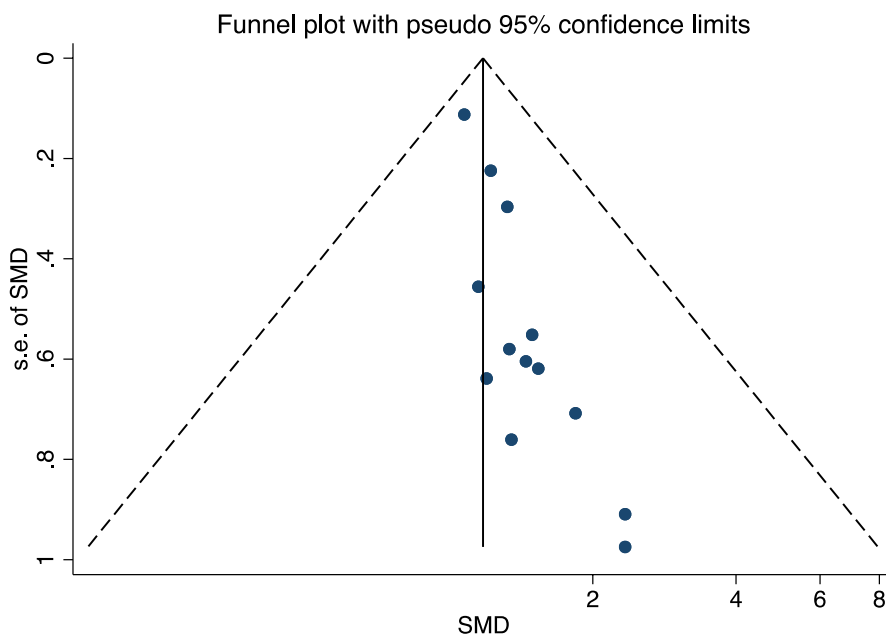


FIGURE 3 Publication bias funnel plot showing standard error by the SMD for the 13 comparisons examining the association between EA and NSSI. Egger's regression intercept, 4.81 ($SE = 0.14$), $p = 0.001$

Although research has corroborated the emotion changing function of NSSI using both subjective (e.g., self-reports) and objective (e.g., physiological) measures (Franklin, 2014; Franklin et al., 2010), there is contemporary evidence

suggesting that the actual removal and/or reduction of emotional pain produces *relief*, which comprises a powerful emotional reaction described in the existing literature as *pain offset relief* (Franklin et al., 2013). It appears that it can be the

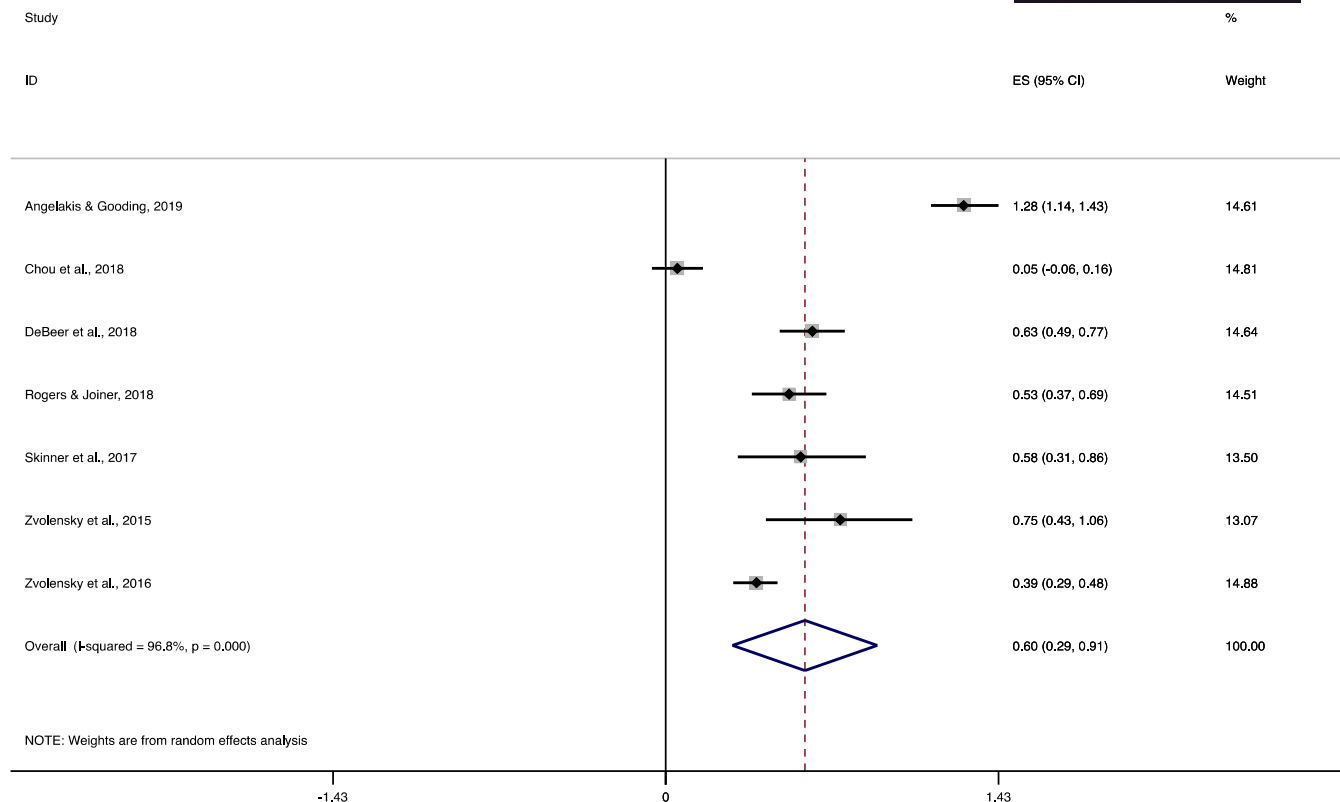


FIGURE 4 Forest plot of the main meta-analysis of the association between EA and overall suicide experiences. *Note:* Random-effects model used; 95% CI, 95% Confidence Interval; ES, Standardized Mean Difference (SMD)

production of this positive feeling of relief together with the reduction of their unpleasant emotional states, which compels people who self-injure to engage in such behaviors (for a review please see Edmondson et al., 2016). Furthermore, there is evidence suggesting that physical pain relief which is produced by NSSI is also associated with emotional pain relief because there exists a large degree of overlap between the neural systems involved in both physical and emotional pain (Eisenberger, 2012). The effects of the positive emotional states known as relief and/or safety in maintaining escape and/or avoidance behaviors have been reliably described within the literature (Angelakis & Austin, 2015a; Engelhard et al., 2015). However, only recently have there been extensive efforts in the application of these findings in understanding and/or treating mental health problems such as depression, anxiety, and obsessive-compulsive disorders which have been strongly associated with NSSI (Angelakis & Austin, 2018; Angelakis et al., 2018; Milosevic, & Radomsky, 2013; Newby, & Moulds, 2010; Olatunji et al., 2011). In accord with the *pain offset relief* interpretation, Angelakis and Austin (2015b) demonstrated that individuals who had been conditioned to avoid point losses in a computerized game by pressing a pedal which also produced a distressing noise tended to do so even in harmless conditions in which point losses had not been scheduled. These data were among the first to examine the reinforcing properties of relief sensations

to positively reinforce self-destructive forms of behavior (for reviews regarding the role of safety signals to reinforce the behaviors that produce them see Dinsmoor, 2001, and Lohr et al., 2007). Convergent evidence from the above studies together with our findings of a weak link between EA and NSSI suggests that the EA model would benefit from the inclusion of the pain offset relief function of NSSI in a revised format.

The effect sizes for the associations between EA, suicide ideation, and behaviors were moderate to large. This finding is in accord with experiencing intense and overwhelming feelings of being defeated and trapped, which is also in accord with psychological models of suicide behavior (Johnson et al., 2008; Williams, 1997; for a review see Taylor et al., 2011). Someone who perceives themselves as being overwhelmingly trapped by external stressors (e.g., financial debt; homelessness; relationship break-downs; criminal convictions; bullying) and/or by internal stressors (e.g., uncontrollable emotional fluctuations; emotional numbing; hallucinations; anxiety; being humiliated) can feel that there is no possibility of hope for the future and no avenue of realistic help (Williams et al., 2005). Therefore, engaging in suicide ideation and/or behaviors provides a way of escaping from such overwhelming negative emotions and/or thoughts that the individual experiences. A recent meta-analysis confirmed that there were strong relationships between perceptions of defeat and entrapment, depression, anxiety, PTSD,

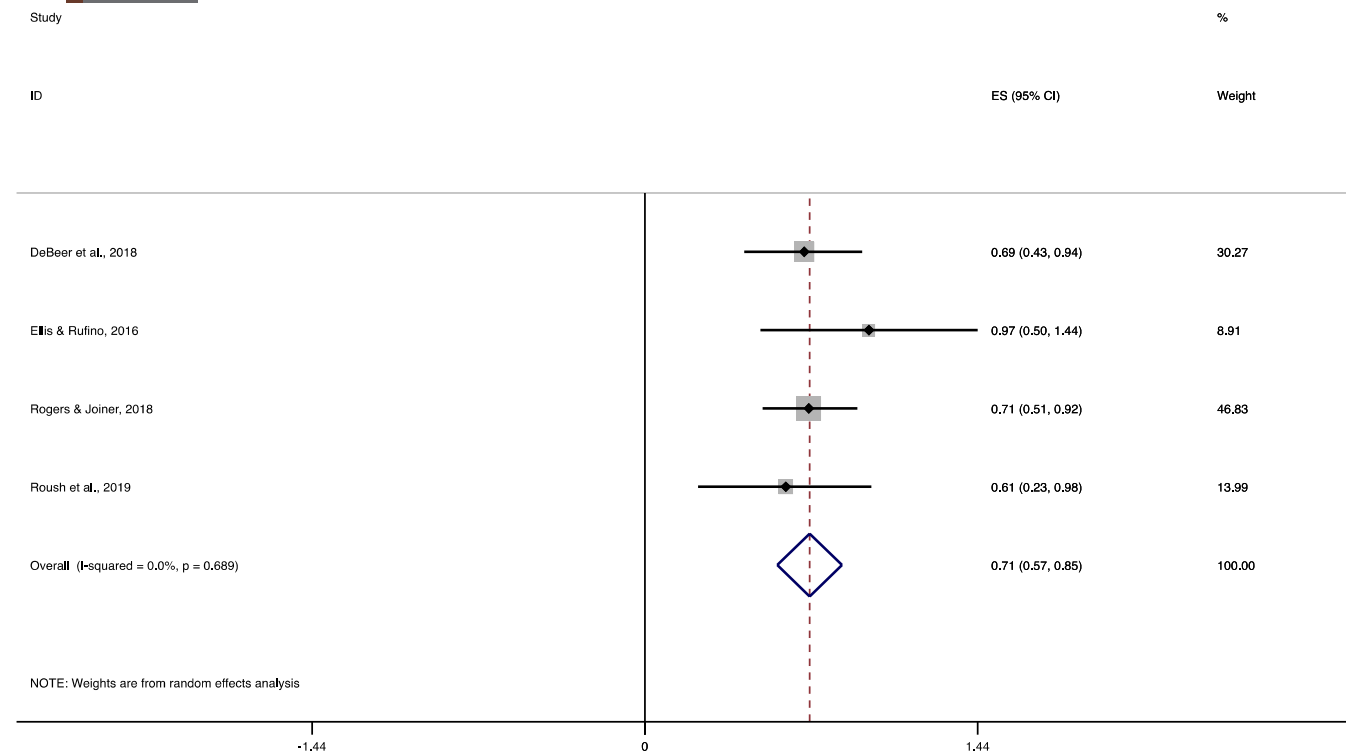


FIGURE 5 Forest plot of the subgroup analysis of the association between EA and suicide ideation. *Note:* Fixed effects model used; 95% CI, 95% Confidence Interval; ES, Standardized Mean Difference (SMD)

and suicide ideation and behaviors (Siddaway et al., 2015). However, to date there are no known studies that have examined the concurrent contribution of both EA and that of perceptions of defeat and entrapment on suicide acts. Therefore, we strongly recommend that future research should examine the interactive effects of EA, defeat, and entrapment in the pathways to suicide thoughts and acts. Such findings may have strong clinical implications because targeting EA (e.g., Kashdan et al., 2006) should also be embodied within suicide prevention protocols.

There were three key limitations which should be considered when interpreting the results of the current meta-analysis. First, because both NSSI, and suicide ideation and behaviors may be similar but distinct complex phenomena (e.g., Fox et al., 2019; Walsh et al., 2018), we anticipated high heterogeneity for the main comparisons, which was, indeed, found to be the case. To compensate, random-effect models were applied. Second, the limited number of individual effect sizes for the associations between EA, NSSI, and suicide experiences did not allow the generalization of these outcomes beyond the specific populations sampled that mainly comprised people from the community. This low number of comparisons may also explain the fact that the meta-regression analyses did not identify any significant moderators. Therefore, caution should be applied when interpreting these non-significant findings with respect to the moderators (Borenstein et al., 2009). Third, it should be noted

that four papers, which were identified and fulfilled our eligibility criteria, were excluded because they did not provide effect sizes which were amendable for meta-analyses, and the authors did not respond to our requests to grant access to these data or the data were not available (Bentley et al., 2015; Gratz et al., 2016; Hulbert & Thomas, 2010; Nielsen et al., 2017). We recommend that a meticulous effort is applied to ensure that all publishable outcomes are accompanied by accessible data (e.g., effect sizes with their associated confidence intervals) which could facilitate conversions among the different effect sizes, and meta-analyses. Last, although not a limitation of the current meta-analytic study, it should be noted that conceptualizations of EA differ as to whether it has a trait like role, a state like role, or, indeed, a more dynamic function with respect to NSSI, and suicide thoughts and behaviors. From a dynamic perspective of EA, it could be argued that it has a role in both the initiation of NSSI and suicide behaviors in addition to having a maintaining effect. However, the use of both qualitative and diary studies (Pindek et al., 2019) in commenting on how EA is conceptualized, operationalized and studied is needed to move this field of study forward.

To conclude, this is the first systematic review and meta-analysis to shed light on the EA models which examine pathways that lead to NSSI and/or suicide experiences (Angelakis & Gooding, 2020; Chapman et al., 2006). Our results indicated that the association between EA and NSSI

TABLE 2 Univariate meta-regression analyses

	<i>b</i> (SE)	<i>p</i> value
<i>Non-suicidal self-injury</i>		
Age (Continuous)	−0.02 (0.04)	0.72
Age (<i>1 = children/adolescents; 2 = adults</i>)	−0.41 (0.38)	0.30
Males (%)	−0.00 (0.00)	0.30
Response rate (%)	−0.03 (0.04)	0.51
Type of research design (<i>1 = individuals from the general community [with or without diagnosed mental health problems]; 2 = psychiatric in-patients/primary care individuals or other [e.g., veterans, inmates]</i>)	0.69 (0.98)	0.49
Type of population (<i>1 = cross-sectional, 2 = prospective/experimental</i>)	0.14 (0.77)	0.86
Type of instrument for EA (<i>1 = AAQ; 2 = AAQ-2; 3 = other</i>)	−0.01 (0.15)	0.93
Screening tools for suicide thoughts and behaviors (<i>1 = indicates not reported or self-report scale; 2 = structured or semi-structured clinical interview</i>)	0.14 (0.77)	0.86
Critical appraisal scores (Continuous)	0.15 (0.17)	0.40

Abbreviations: AAQ, The Acceptance and Action Questionnaire; AAQ-2, The Acceptance and Action Questionnaire-Revised; EA, Experiential Avoidance; SE, Standard Error.

was significant but weak, and most likely inflated, whereas a moderate to stronger significant relationship between EA, suicide ideation, and behaviors was supported. Future studies may benefit from advancing this line of research by focusing on two key priorities, namely, (i) the inclusion of recent advances which involve the pain offset relief function of NSSI, and (ii) the integration of quantitative and qualitative research methods together with diary studies. Diary studies reduce memory biases, especially when experiences of NSSIs are reported, and sample in-the-moment experiences thus increasing the accuracy of the data (Hepp et al., 2020).

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CONFLICT OF INTEREST

All the authors declare that they have no conflicts of interest.

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